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Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (South Florida)

GRAY, LANE, MUTTON and YELLOWTAIL SNAPPERS

Fish and Wildlife Service
U.S. Department of the Interior

Coastal Ecology Group
Waterways Experiment Station
U.S. Army Corps of Engineers

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Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (South Florida)

GRAY, LANE, MUTTON, AND YELLOWTAIL SNAPPERS

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PREFACE

This species profile is one of a series on coastal aquatic organisms, principally fish, of sport, commercial, or ecological importance. The profiles are designed to provide coastal managers, engineers, and biologists with a brief comprehensive sketch of the biological characteristics and environmental requirements of the species and to describe how populations of the species may be expected to react to environmental changes caused by coastal development. Each profile has sections on taxonomy, life history, ecological role, environmental requirements, and economic importance, if applicable. A three-ring binder is used for this series so that new profiles can be added as they are prepared. This project is jointly planned and financed by the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service.

Suggestions or questions regarding this report should be directed to one of the following addresses.

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Vicksburg, MS 39180

CONVERSION TABLE

Metric to U.S. Customary

Multiply	By	To Obtain
millimeters (mm)	0.03937	inches
centimeters (cm)	0.3937	inches
meters (m)	3.281	feet
kilometers (km)	0.6214	miles
square meters (m^2)	10.76	square feet
square kilometers (km^2)	0.3861	square miles
hectares (ha)	2.471	acres
liters (l)	0.2642	gallons
cubic meters (m^3)	35.31	cubic feet
cubic meters	0.0008110	acre-feet
milligrams (mg)	0.00003527	ounces
grams (g)	0.03527	ounces
kilograms (kg)	2.205	pounds
metric tons (t)	2205.0	pounds
metric tons	1.102	short tons
kilocalories (kcal)	3.968	British thermal units
Celsius degrees	1.8(°C) + 32	Fahrenheit degrees

U.S. Customary to Metric

inches	25.40	millimeters
inches	2.54	centimeters
feet (ft)	0.3048	meters
fathoms	1.829	meters
miles (mi)	1.609	kilometers
nautical miles (nmi)	1.852	kilometers
square feet (ft^2)	0.0929	square meters
acres	0.4047	hectares
square miles (mi^2)	2.590	square kilometers
gallons (gal)	3.785	liters
cubic feet (ft^3)	0.02831	cubic meters
acre-feet	1233.0	cubic meters
ounces (oz)	28.35	grams
pounds (lb)	0.4536	kilograms
short tons (ton)	0.9072	metric tons
British thermal units (Btu)	0.2520	kilocalories
Fahrenheit degrees	0.5556(°F - 32)	Celsius degrees

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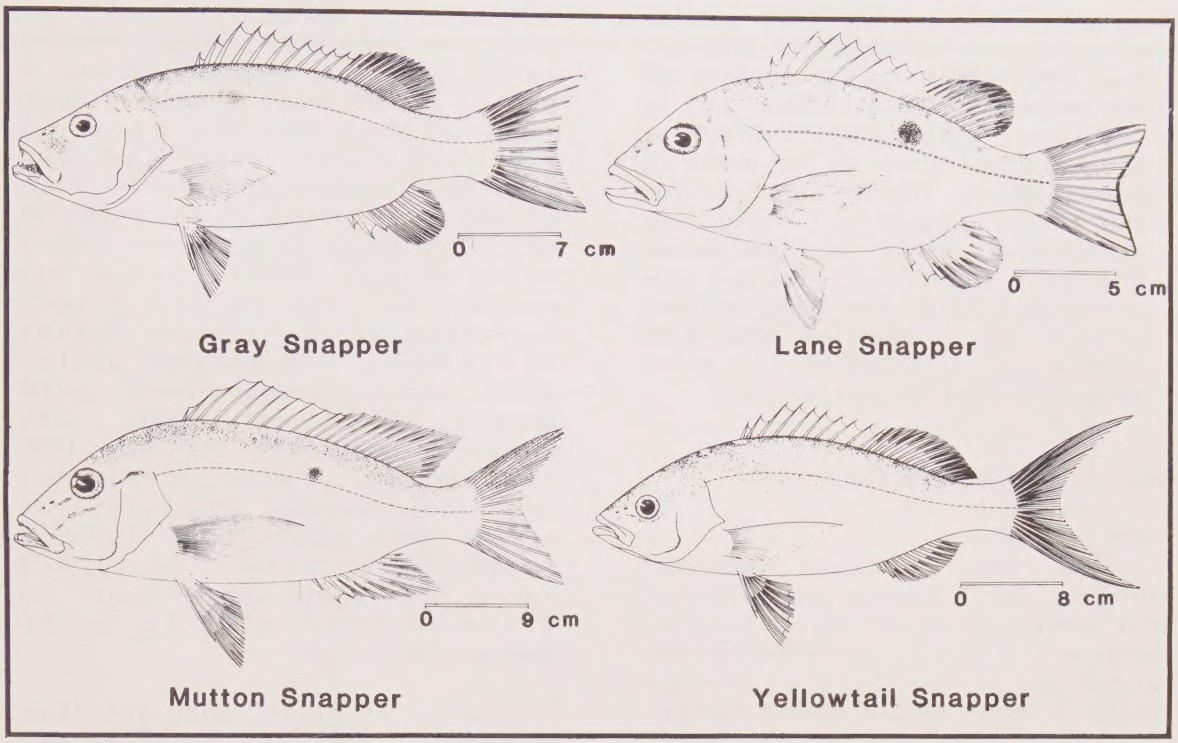

Figure 1. Gray, lane, mutton, and yellowtail snappers. Adapted from illustrations in Evermann and Marsh (1902).

GRAY, LANE, MUTTON, AND YELLOWTAIL SNAPPERS

NOMENCLATURE/TAXONOMY/RANGE

Scientific name. . . Lutjanus griseus (Linnaeus)
Preferred common name. . Gray snapper (Figure 1)
Other common names . . . . . Mangrove snapper, grey snapper, lowyer, mango snapper, black snapper, caballerote, pargo prieto, pargo, pargo dienton, pargo de piedra, pargo moreno, vivaneau sarde grise, aquadera (Cervigon 1966; Starck 1971; Fischer 1978)

Scientific name . . Lutjanus synagris (Linnaeus)
Preferred common name. . Lane snapper (Figure 1)
Other common names . . Candy striper, rainbow snapper, pargo guanapo, pargo biajaiba, vivaneau gazou, ariaco (Cervigon 1966; Fischer 1978)

Scientific name . . . Lutjanus analis (Cuvier)
Preferred common name. . . . . Mutton snapper (Figure 1)
Other common names . . . Mutton fish, king snapper, pargo cebadai, pargo criollo, vivaneau sorbe (Cervigon 1966, Fisher 1978)

Scientific name . . Ocyurus chrysurus (Bloch)
Preferred common name. . . Yellowtail snapper (Figure 1)
Other common names . . . Rabirrubia, vivaneau quaue jaune (Cervigon 1966; Fischer 1978)
Class . . . . . Osteichthyes
Order . . . . . Perciformes
Family . . . . . Lutjanidae

Geographic range: The four species of snappers inhabit the tropical and subtropical coastal waters of the western Atlantic Ocean, and in the summer they inhabit waters of the temperate zones as far north as Massachusetts (North Carolina for the lane snapper). Along the continental shelf of peninsular Florida, the four species are associated with the hard bottoms (Figure 2). Juveniles are more broadly distributed, often inhabiting shallow estuaries.

MORPHOLOGY/IDENTIFICATION AIDS[1]

The four snapper species' individual descriptions are followed by a summary of their morphological characters (Table 1) and a key to the Lutjanidae of the Gulf of Mexico (Table 2) which should enable identification of most species off south Florida as well. There is some disparity between Table 1 and Table 2 in the data on numbers of gill rakers.

Gray Snapper

Dorsal fin, 10 spiny rays, 14 soft rays; anal fin, 3 spiny rays, 7-8 soft rays. Number of pored scales along lateral line, 43-47. Number of gill rakers on first gill arch, 9-10 on upper portion, 21-22 on lower. Body somewhat elongate; not strongly compressed; head profile nearly straight or slightly convex from snout to nape. Head length is 33% to 38% of standard length (SL); body depth is 31% to 38% of SL. Snout length 33% of head length; eye, 21%. Mouth large, maxillary reaching front of pupil, 31% of head length. Both jaws with a narrow band of villiform teeth; upper jaw also with four canines anteriorly, two of these enlarged. Vomer with villiform teeth in an arrow-shaped patch with a medial posterior projection. Preopercle finely serrate above with coarser spines at its deeply emarginated angle. dorsal spines strong; fourth spine longest, 40% of head length. Soft dorsal rounded, the 9th and 10th rays longest. Caudal marginate. Anal fin somewhat angulate, its second spine equal to or slightly longer than third. Pectorals short, fin length nearly equal to distance from snout to upper preoperclar margin.

Color in life: Body and fins variable: gray to green-brown, generally with reddish tinges. median fins darker, often edged with white or yellow. Pectorals nearly colorless. No black spot on body side. Young with a black bar from tip of snout through eye, often with a blue streak beneath eye. Young often with a pattern of narrow pale bars laterally. Juveniles and adults commonly bear orange or dark brown dots on centers of scales on sides, forming rows of spots.

Lane Snapper

Dorsal fin, 10 spiny rays, 12-13 soft rays; anal fin, 3 spiny rays, 8-9 soft rays. Number of pored scales along lateral line, 47-52. Number of gill rakers on first gill arch, 6-7 on upper portion, 13-14 on lower. Body oblong and compressed; head profile nearly straight from snout to nape. Head length 38% of SL, body depth 34% to 42% of SL. Snout length 33% of head

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[1]Largely extracted from Jordan and Evermann (1898), Anderson (1967), Böhlke and Chaplin (1968), Randall (1968), and Hoese and Moore (1977). See the references for explanations of abbreviations and measurements.

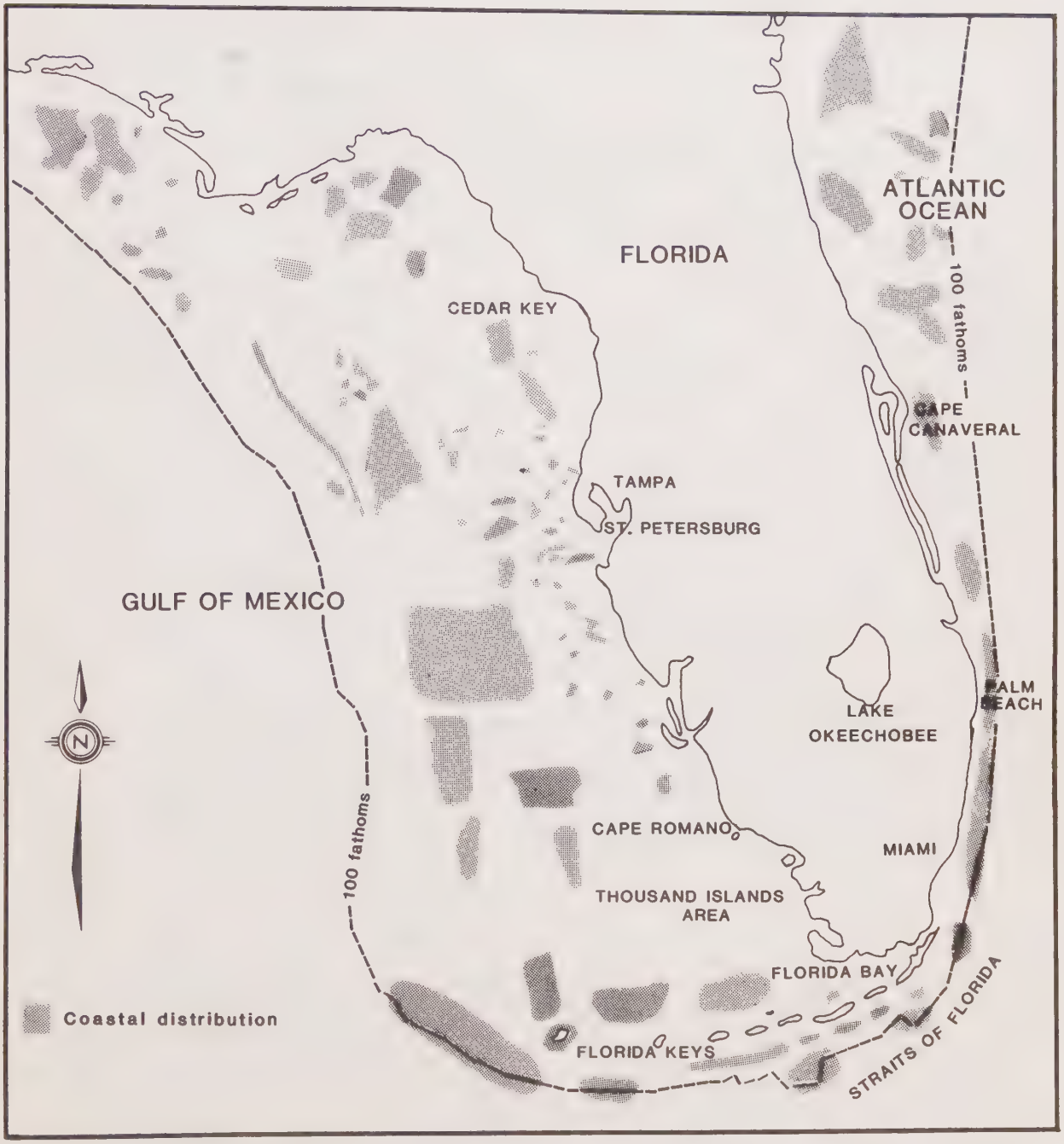

Figure 2. The distribution of the preferred habitat of adult snappers (hard bottoms including both natural and artificial reefs) off the south coast of Florida.

Table 1. Summary of morphological characters of four snappers.

Character	Species of snapper			
	Gray	Lane	Mutton	Yellowtail
Dorsal fin elements[a]	X, 14	X, 12-13	IX-XI, 13-14	X, 12-14
Anal fin elements[a]	III, 7-8	III, 8-9	III, 8	III, 8-9
Pored scales in lateral line	43-47	47-52	47-51	48-49
Gill rakers	9-10+21-22	6-7+13-14	6-8+12-13	21-22 (total)
Head length[b]	33%-38%	38%	34%-38%	37%
Body depth[b]	31%-38%	34%-42%	31%-40%	30%-34%
Posterior body spot	Absent	Slightly larger than eye, one-fourth below lateral line	Equal to pupil diameter, entirely above lateral line	Absent
Horizontal body stripe	Absent	Absent	Absent	Present

[a]Roman numerals indicate number of spiny rays, arabic numerals soft rays.

[b]Given as a percentage of standard length.

length; eye small, 20% of head length. Maxillary reaching to front of eye, 36% of head length. Narrow band of villiform teeth in each jaw. The upper jaw also bears four canine teeth, two of them enlarged. Villiform teeth on vomer in an arrow-shaped patch without a medial posterior projection. Preopercle finely serrate above with coarser spines at its angle, which is emarginate. Dorsal spines slender; the fourth is longest, 37% of head length. Soft dorsal somewhat angulate posteriorly, the eighth ray longest. Caudal fin moderately emarginate. Anal fin rounded, not angulate; its second spine stronger than third, but of equal length. Pectoral fins 26.3% to 30.3% of SL, reaching front of anal fin.

Color in life: Diffuse black spot or blotch slightly larger than eye below soft portion of dorsal fin, the lateral line transecting its lowermost fourth. Body silvery pink to red with seven or eight yellow stripes; wavy diagonal or yellow lines on lateral surface above lateral line. Caudal fin red to pink, edges dusky. Anal, pelvic, and

Table 2. Key to the snappers of the Gulf of Mexico (Hoese and Moore 1977).

1. Dorsal spines X; lateral line scales fewer than 60 2
   Dorsal spines XII; lateral line scales more than 60. . . . .Vermilion snapper, *Rhomboplites aurorubens*.

2. Scales on soft dorsal and anal fins, with last rays of these fins not produced; dorsal rays 12-14; gill rakers on lower limb of first arch few (7-10) or numerous (19-21) 3
   No scales on soft dorsal anal fins, with last rays produced as filaments (which may be broken off); dorsal rays 10-11; gill rakers on lower limb of first arch 16-17 . . . Wenchman, *Pristipomoides aquilonaris*.

3. Gill rakers on lower limb of first arch few (7-10); caudal lobes not produced in adults; no pterygoid teeth. 4
   Gill rakers on lower limb of first arch numerous, 19-21; caudal lobes produced in adults; pterygoid teeth present . . . Yellowtail snapper, *Ocyurus chrysurus*.

4. Dorsal rays usually 14, rarely 13. 5
   Dorsal rays normally 12 . . . Lane snapper, *Lutjanus synagris*.

5. Vomerine tooth patch with posterior extension 6
   Vomerine tooth patch without posterior extension 8

6. Gill rakers on lower limb of first arch 7-8; anal rays usually 8 . . . 7
   Gill rakers on lower limb of first arch 9-10; anal rays usually 9 (8 in 11% of Gulf of Mexico specimens) . . . Red snapper, *Lutjanus campechanus*.

7. Body comparatively stout, greatest depth 36%-43% (usually 37%-42%) of standard length; pectoral fin in adults longer than distance from tip of snout to posteriormost edge of preopercle (in juveniles pectoral fin as in *Lutjanus griseus*) 9
   Body comparatively slender, with greatest depth 31-38% (usually 32-37%) of standard length; pectoral fin in adults as long as distance from tip of snout to posteriormost edge of preopercle . . . Gray snapper, *Lutjanus griseus*.

8. Lateral-line scales 45-47; body depth 29%-32% of standard length; caudal without pointed lobes . . . Cubera snapper, *Lutjanus cyanopterus*.
   Lateral-line scales 47-51; body depth 31-40% of standard length; caudal with pointed lobes . . . Mutton snapper, *Lutjanus analis*.

9. Scales large[a] with 39-44 (usually 40%-43%) transverse rows between "scale bone"[a] and base of caudal fin; 40-45 pored scales in lateral line; 5-7 rows between base of dorsal and lateral line . . . Schoolmaster, *Lutjanus apodus*.
   Scales small, with 45-49 transverse rows between "scale bone" and base of caudal; 46-48 pored scales in lateral line . . . Dog snapper, *Lutjanus jocu*.

[a]An enlarged scale above and behind the gill slit.

distal portion of dorsal fins yellow. Proximal portions of dorsal fin reddish.

Mutton Snapper

Dorsal fin, 9 to 11 (usually 10) spiny rays, 13-14 soft rays; anal fin, 3 spiny rays, 8 (rarely 7) soft rays. Number of pored scales along lateral line, 47-51. Number of gill rakers on first gill arch, 6-8 on upper portion, 12-13 on lower. Body deep and compressed; dorsum is elevated with a steep straight profile to tip of snout. Head length is 34% to 38% of SL, body depth 31% to 40% of SL. Snout length 38% of head length; eye small, 18.5% of head length. Mouth moderate; maxillary barely reaching front of eye, 37% of head length. Upper and lower jaws with a narrow band of villiform teeth; six canine teeth in upper jaw, four enlarged. Vomer with villiform teeth in a wedge-shaped patch without a posteriorly directed medial projection. Coarse serration along entire edge of preopercle; notch at angle shallow. Dorsal spines weak and slender, dorsal outline nearly straight; fourth spine longest, 37% of head length. Margin of soft dorsal angulate. Caudal fin deeply emarginate. Anal fin angular posteriorly, similar to soft dorsal margin; second and third spines equally strong. Pectorals long, reaching just past anal origin, 26% to 31% of SL.

Color in life: There are both barred and plain color phases which correspond to resting and swimming activities, respectively. Adult olive above, white laterally, and reddish below. All fins with red, caudal margin black. Snout with irregular diagonal blue line continuing in back of eye; another irregular blue line runs from middle of maxillary to eye. Lateral subdorsal spot entirely above lateral line, equal to pupil diameter. Lateral subdorsal spot in juveniles equal to eye and lower half projecting below lateral line.

Yellowtail Snapper

Dorsal fin, 10 spiny rays, 12-14 soft rays; anal fin, 3 spiny rays, 8-9 soft rays. Number of pored scales along lateral line, 48-49. Number of gill rakers on first gill arch, 21-22. Body fusiform; comparatively elongate dorsum only slightly elevated; nape to dorsal fin gently curved. Head length 37% of SL, body depth 30% to 34% of SL. Snout length 33% of head length, eye 20% of head length. Preorbital narrow, 15% of head length at its narrowest width. Mouth in comparison with other snapper small, oblique, the lower jaw projecting. Maxillary extending to front of eye, 38% of head length. Upper jaws with a narrow band of villiform teeth with five or six somewhat small canine teeth laterally. Lower jaw with larger villiform teeth. Teeth on vomer in arrow-shaped patch with a medial posteriorly directed projection. Preopercle weakly serrate, teeth at angle also shallowly emarginate. Dorsal spines strong; fifth is longest, 42% of head length. Dorsal fin not deeply emarginate. Caudal fin long, deeply forked; upper lobe longer. Pectorals long, reaching anus; 83% of head length. Third anal spine longer than second.

Color in life: A prominent yellow mid-lateral stripe beginning on snout and broadening posteriorly to entire depth of caudal peduncle. Entire caudal fin yellow. Yellow spots on body above yellow lateral stripe. Background body color gray to olive above, white below. Dorsal fin yellow distally, pale at base anteriorly. All other fins pale yellow to clear.

REASON FOR INCLUSION IN SERIES

These four snapper species compose a major portion of both the sport and commercial catches of Florida's snapper fishery. They are generally associated with reefs, on hard or live bottoms. They are highly sought after for human food. These snappers are also an important shallow-water component of the south Florida reef and near-reef ichthyofauna. Gray snappers, in particular, are associated with estuarine areas as adults, and especially as juveniles. These snappers are important members of marine, nearshore reef, or reef-like biotopes.

LIFE HISTORY

Spawning

Most snappers, including these four species, spawn in groups (Wicklund 1969; Starck 1971; Thompson and Munro 1974), usually offshore (Croker 1962; Springer and Woodburn 1960). This may indicate an actual offshore movement during reproduction as suspected for a number of other tropical reef-associated species (Johannes 1978), or part of a tendency for larger, older (i.e., sexually mature) coastal fishes to occur in deeper water than juveniles. Unconfirmed observations indicate that gray snapper spawn at dusk as part of a daily activity cycle and may have peak spawning periods that follow a lunar cycle (Starck 1971).

Seasonal spawning patterns vary among these four lutjanid species, but generally, once they attain sexual maturity, they have a protracted spawning period with seasonal peaks (Erdman 1976). The length of the spawning period may be even longer for fish in the warmer parts of their range. No data are available on the time of spawning of mutton snapper.

Individual gray snapper probably spawn more than once during a spawning season (Starck 1971; Bashirullah 1975). Off Venezuela, the spawning season began in July and ended in October (Guerra-Campos and Bashirullah 1975).

In Cuba, lane snapper spawn from March through September, with spawning peaks in July and August (Rodriguez-Pino 1962; Druzhinin 1970). Erdman (1976) reported a spawning peak in May off Puerto Rico, and Munro et al. (1973) noted mature eggs in lane snapper caught in February off Jamaica.

Yellowtail snapper were sexually mature from March to May in nearshore areas off Jamaica, but offshore they apparently spawned year round (Munro et al. 1973). Erdman (1976) indicated a decline in spawning activity among specimens caught during November through December off Puerto Rico. Piedra (1969) reported that yellowtail snapper females off Cuba had ripe gonads from March to August.

Age at maturation is apparently unknown for these species, and most studies relate maturity to length. Thompson and Munro (1974) wrote that lane snapper males and females attain sexual maturity at 18 cm fork length (FL). Yellowtail snapper males become sexually mature at 26 cm FL and females at 29 to 31 cm FL. Gray snapper sex ratios have been reported as equal off Florida (Starck 1971), but off Cuba a ratio of two females to one male has been observed (Guerra-Campos and Bashirullah (1975).

Hybridization of yellowtail snapper with lane snapper has been reported (Rodriquez-Pino 1961; = Lutjanus ambiguus). Yellowtail snapper have also been thought to hybridize with the dog snapper (Lutjanus jocu) as stated by Jordan and Evermann (1898; = Lutjanus lutjanoides).

Fecundity and Eggs

Fecundity estimates reported for all four snapper species vary widely (Table 3). A partial reason for this variation may be the relation between fecundity and fish size, as noted for the gray snapper (Guerra-Campos and Bashirullah 1975), when fecundity = 0.00299 x total length (TL, mm)$^{3.26}$; fecundity = 1478.82 x weight (grams)$^{0.973}$. Gray snapper eggs are small (between 0.4 and 0.6 mm in diameter) with one central oil globule; eggs are apparently not adhesive (Starck 1971; Guerra-Campos and Bashirullah 1975). Lane snapper eggs are larger (between 0.7 and 0.8 mm Rodriguez-Pino 1962). Erhardt (1976) examined the microscopic anatomy of lane snapper ovarian egg membranes; they generally agreed with descriptions given for those of other perciform fishes (Hayashi 1972). Most lutjanid species produce pelagic eggs (Breder and Rosen 1966).

Larvae

Little is known of lutjanid larvae, as they tend to be planktonic at a length less than 10 mm TL (Barans and Powles 1977). Laboratory-reared larvae of gray snapper described by Richards and Saksena (1980) were similar in appearance to other described snapper larvae (i.e., red snapper Lutjanus campechanus by Collins et al. 1980; vermilion snapper Rhomboplites aurorubens by Laroche 1977). According to Richards and Saksena (1980:515), "Pigmentation was sparse in the larvae, being confined to the ventral midline of the tail, gut, pelvic fin rays, cleithral symphysis, brain and on the base of the dorsal

Table 3. Fecundity estimates (no. of eggs) for four species of snappers. (SL = standard length, TL = total length, FL = fork length).

Species and fecundity estimates	Fish length (mm)	Source
Gray		
590,000	315 SL	Starck 1971
1,086,682-5,900,010	488-660 TL	Guerra-Campos and Bashirullah 1975
Lane		
347,416-994,787	225-335 FL	Rodriguez-Pino 1962
Mutton		
1,365,975	512 FL	Rojas 1960
Yellowtail		
99,660-1,472,594	292-382 FL	Piedra 1969

fin." Gray snapper larvae transformed to juveniles at a size between 6.3 and 9.6 mm SL (Richards and Saksena 1980).

Pre-Adult Phase

Data are scarce on the life history of juveniles or pre-adults of these four snapper species (Thompson and Munro 1974). Pre-adult gray snapper often occupy habitats different from that of adults. Juveniles are usually associated with shallow Thalassia grass beds, mangrove roots, jetties, and pilings (Starck 1971; Thompson and Munro 1974). Juveniles using the inshore areas of south Florida for nurseries are conspicously absent from March through May, but are abundant in these areas from July through September (Springer and McErlean 1962). Pre-adult mutton snapper also use inshore grass beds (Springer and McErlean 1962).

Adults

Adult gray and lane snappers tend to occupy a wide variety of habitats. These include natural and artificial hard-bottom substrates, as well as soft-bottom areas in certain parts of their ranges. Mutton snapper are often associated with sand, sea grass, and coral rubble. Yellowtail snapper most often occupy water just above the hard-bottom areas with which they associate (Randall 1967). Adult snapper tend to remain in an area once they become established. Tagging studies indicate little movement by adult snapper; only 2 of 13 tagged and recovered gray snapper showed evidence of moving more than 5 nmi in 4 years. Mutton and yellowtail snapper showed little movement 262 days after release (Beaumariage 1969). Gray snapper tend to move in a daily activity pattern associated with nocturnal feeding habits, and yellowtail snapper are semipelagic wanderers over the reef habitat (Moe 1972).

GROWTH CHARACTERISTICS

Length-weight equations have been determined only for the lane and yellowtail snapper, although Starck (1971) presented a scatter plot of the lengths and weights of gray snapper. The length-weight equations follow: lane snapper -- weight (g) = 4.965×10^{-5} length (mm TL) $^{2.80}$ (Rodriguez-Pino 1962) and weight (g) = 1.02×10^{-4} length (mm TL)$^{2.6524}$ (Manooch and Mason 1984); and yellowtail snapper -- weight (g) = 1.45×10^{-2} length (mm TL)$^{3.032}$ (Thompson and Munro 1974). The estimated ranges of maximum lengths (mm, TL) for the four species (Manooch and Mason 1984; Thompson and Munro 1974; Bohlke and Chaplin 1968) are as follows:

Gray snapper	500-900
Lane snapper	375-512
Mutton snapper	642-750
Yellowtail snapper	688-750.

Scales, otoliths, and vertebrae have all been successfully used to determine the age of snappers (Bortone and Hollingsworth 1980). Scales have been useful for aging the gray snapper (Croker 1962; Starck 1971; Thompson and Munro 1974) and otoliths for aging gray and lane snappers (Manooch and Mason 1984; Rodriguez-Pino 1962; Alegria-C and de Menezes 1970; Claro-Madruga and Bustamente Pola 1977). There are apparent difficulties in aging yellowtail snapper with otoliths (Thompson and Munro 1974); Piedra (1969) found vertebrae to be useful, however, and noted that two rings equaled one annulus.

Growth among snappers varies considerably (Table 4). The lack of general agreement on their growth rate may be due to differences in methodologies. For example, Claro-Madruga and Bustamente Pola (1977) noted that, although one annulus in gray snapper was produced each year (between February and July off Cuba, but between February and March off south Florida; Starck 1971), the first ring was not an annulus. This fact alone would account for major differences in growth as estimated by different researchers.

Individual growth rates determined from tagged-and-released snapper also indicated that growth is variable, probably being strongly influenced by local habitats and their abundance of food. Starck (1971) found that gray snapper growth varied from 1.6 to 7.4 mm/month. Growth rates derived from back-calculated lengths at mean annulus formation indicate a narrower range of mean monthly growth rates (not including the first year of growth): 3.7 to 4.5 mm/month, gray snapper (Croker 1962; Starck 1971; Claro-Madruga and Bustamente Pola 1977); 2 to 4.0 mm/month lane snapper (Rodriguez-Pino 1962; Alegria-C. and de Menezes 1970); 3.3 mm/month, yellowtail snapper (Thompson and Munro 1974).

Table 4. Mean back-calculated fork lengths (mm) of gray, lane, and yellowtail snapper by age group. Data are from the following sources: (1) estimated from Starck 1971; (2) Croker 1962; (3) Claro-Madruga and Bustamente Pola 1977; (4) Rodriguez-Pino 1972; (5) estimated from Alegria-C. and de Menezes 1970; (6) Piedra 1969.

Age group	Species					
	Gray			Lane		Yellowtail
	(1)	(2)	(3)	(4)	(5)	(6)
0			61	101		
1	79	81	168	169	110	124
2	143	180	236	206	183	177
3	199	241	286	237	241	218
4	255	295	327	266	287	253
5	293	352	357	273	323	286
6	334	431	375	303	352	316
7	381	456				353
8	438					360
9	478					

COMMERCIAL/SPORT FISHERY

The Florida landings of gray, lane, mutton, and yellowtail snappers are considerable, but are exceeded by the red and vermilion snappers (National Marine Fisheries Service 1970-79). The four species are generally captured by hook and line with cut bait, but are also caught by fish traps and spear guns in the southern portion of Florida. A summary of Florida's commercial landings and values (Table 5) indicates increased catches of gray and lane snapper between 1969 and 1978, whereas mutton and yellowtail snapper landings have fluctuated and show no discernible trends in the same 10-year period. Fishery management plans have been prepared for the reef fish resources along the South Atlantic U.S. coast, which includes eastern Florida; and the Gulf of Mexico, which includes Florida's west coast (South Atlantic Fishery Management Council 1982; Gulf of Mexico Fishery Management Council 1980). Data summarized in these

Table 5. Florida commercial landings (thousands of pounds) and (in parentheses) dockside values (thousands of U.S. dollars) for four snapper species, 1969-1978 (National Marine Fisheries Service 1970-1979).

Year	Species			
	Gray	Lane	Mutton	Yellowtail
1969	587 (147)	18 (3.6)	212 (83)	970 (446)
1970	826 (142)	19 (4.5)	389 (187)	1,192 (548)
1971	552 (169)	20 (6)	455 (215)	1,093 (486)
1972	704 (245)	20 (7)	437 (232)	1,020 (542)
1973	672 (244)	36 (12)	548 (342)	943 (581)
1974	719 (277)	33 (12)	459 (272)	1,043 (647)
1975	600 (228)	41 (18)	397 (232)	798 (543)
1976	687 (261)	56 (26)	359 (252)	978 (750)
1977	726 (349)	36 (19)	369 (319)	809 (712)
1978	743 (426)	42 (26)	457 (546)	871 (875)

plans indicate that catch trends within the larger areas were generally the same as those restricted to Florida, primarily because the majority of snapper in both areas are landed in Florida. In the south Atlantic portion of the fishery, yield-per-recruit models indicated that gray and yellowtail snapper are probably being overfished.

Sport fishing for these species is important but poorly documented. A recent survey (National Marine Fisheries Service 1980), however, indicated that in 1979 recreational fishermen caught about 4.6 million gray and other snapper (excluding red and vermilion snapper) from the South Atlantic and Gulf of Mexico. If one assumes that each fish averaged about 1.5 lb, the weight of the 1979 recreational catch of these snapper species was 6.9 million lb. Inasmuch as the total Florida commercial catch of these four species in 1978 was only 2.1 million lb., one can assume that Florida's sport fishery substantially affected the fish stocks.

ECOLOGICAL ROLE

These snapper species are generally classified as euryphagic carnivores, but data on feeding habits are limited. Gray snapper are purported to feed on portunid crabs (34.8% frequency of occurrence), spider crabs (3.9%), and other crustaceans in the Dry Tortugas area (Longley et al. 1925). Croker (1962) found that gray snapper from south Florida ate fishes (34% in frequency, mostly anchovies) and crustaceans (79%), which included grapsid crabs and penaeid shrimps. Juvenile gray snapper ate primarily crustaceans (93% in frequency, mostly amphipods and shrimps) and fish (5%) (Starck 1971). The adults tended to eat more fish (20.6% to 61.9% in frequency) and fewer crustaceans than juveniles. Similar differences between feeding of juveniles and adults were reported off Cuba on an artificial reef (Valdez-Munoz and Silva Lee 1977). The gray snapper diet varied considerably between biotopes. Gray snapper are apparently nocturnal predators (Starck and Davis 1966), at least as adults (Starck 1971), and forage away from their reef habitats at night, whereas juveniles apparently feed diurnally among grass beds.

Like gray snapper, lane snapper live in a wide variety of habitats--e.g., from coral reefs in clear water to turbid, brackish water over soft substrates; consequently they feed on a wide variety of organisms. A summary of lane snapper food habits revealed that they feed on a variety of crustaceans and fish (Randall 1967). Rodriguez-Pino (1962) noted that off Cuba they ate fish (32% by volume), crustaceans (28%), annelids (12%), mollusks (1%), algae (2), and unidentified material (26%).

Mutton snapper are nocturnal and diurnal predators on crustaceans and fish, and occur over sand, seagrass, and coral rubble substrates (Randall 1967). Crabs make up 44.4% of their diet by volume in the Caribbean, followed by fish (29.8%), and gastropods (13%), as well as octopods, hermit crabs, and shrimp.

Juvenile yellowtail snapper live primarily among seagrasses, but both juveniles and adults often feed above the substrate. Randall (1967) reported that adults eat crabs (23.3% by volume), shrimp (16.2%), and fish (15.9%). Off Cuba, yellowtail snapper stomach percent volumes consisted of fish remains (53%), whole fish (32%), crustacean remains (10%), whole crustaceans (7%) and mollusk remains (1%) (Piedra 1969). Yellowtail snapper have probably the

most diverse food habits of the four snappers considered here.

Natural predators include sharks and other larger predatory fishes, including other snapper species. Fishing mortality, as well as inadvertent fishing mortality on juveniles caused by shrimp trawlers over soft-bottom areas, accounts for a large proportion of their total mortality (Gulf of Mexico Fishery Management Council 1980).

Artificial reefs and other structures are suitable habitats for these species (Hastings et al. 1976; Valdez-Munoz and Silva Lee 1977; Hastings 1979).

ENVIRONMENTAL REQUIREMENTS

Temperature Limits

Temperature limits for these species are approximations based on field observations. Rivas (1970) reported the temperature range for gray snapper as 18.3° to 27.2°C, and the mean as 21.7°C; lane snapper, 16.1° to 28.9°C, mean 24.0°C; and mutton snapper, 18.9° to 27.8°C, mean to 24.8°C. Gray snapper have been collected in the 13.4° to 32.5°C range (Springer and Woodburn 1960). The available data for gray snapper indicate the lower lethal limit to be between 11° and 14°C (Starck 1971). Springer and Woodburn (1960) indicated that the temperature range for lane snapper in the Tampa Bay area was 15.0° to 27.5°C. Under laboratory conditions, the preferred upper temperature range for juvenile yellowtail snapper was 24° to 30°C and the ultimate upper lethal temperature was between 33.5° and 34°C (Wallace 1977). The acclimation temperature seemingly had no effect on the upper lethal temperature.

Salinity

Gray snapper enter freshwater lakes and streams in south Florida (Gunter and Hall 1963). Juveniles of all four snapper species considered here use estuaries as nursery areas. Gray snapper have been collected at a salinity range of 1.0 to 35.0 ppt, and lane snapper at 19.1 to 35.0 ppt (Springer and Woodburn 1960). Adults live generally offshore in salinities approaching 35 ppt.

Substrate

Adult snappers of these species generally live near coral reefs or other hard-bottom features, and juveniles in inshore areas. Juvenile gray snapper are common in shallow water grass beds. Small adults tend to congregate near hard bottoms, whereas mature adults tend to associate with reefs (natural and artificial) in deeper offshore waters (Starck 1971). Lane snapper often occur in grass beds along with gray snapper (Starck 1971), but are more abundant as juveniles in soft- and sand-bottom areas where shrimping is conducted. Adults tend to be found over mud- and sand-bottom areas in bays and channels.

Mutton snapper frequently inhabit open waters; both adults and juveniles may associate with grass beds, but the adults also live in or near patch reefs of coral and rock rubble and sponge patches. Yellowtail snapper are less associated with hard bottoms than the other snappers; they are found on patch reefs and on the outer edges of deeper coral reefs. Juveniles also live among grass beds and finger coral (Starck 1971).

Depth

From catch statistics, Rivas (1970) and Thompson and Munro (1974) reported depth distributions where large numbers of adults of the four species were taken. Maximum depths reported by Fischer (1978), however, were much greater (Table 6). Generally, larger snapper inhabit deeper areas than smaller snapper, although there are many exceptions.

Table 6. Water depths for gray, lane, mutton, and yellowtail snappers.

	Depths (m)		
	Range		
	Rivas (1970)	Thompson & Munro (1974)	Maximum Fischer (1978)
Gray	31-49	0-10	180
Lane	29-59	100-120	--
Mutton	40-59	--	--
Yellow-tail	--	20-40	70

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16. Abstract (Limit: 200 words)

These four snapper species have similar morphologies as well as life history and environmental requirements. With some exceptions they are restricted to tropical and subtropical coastal areas of the western Atlantic. Adults often associate with coral reef and other hard-bottom communities. Juveniles and pre-adults usually inhabit shallow, inshore areas and are often found in seagrass beds. Reproduction usually takes place offshore in the warmer months of the year. Fecundity is positively related to female body size, but there is substantial variation both within and among the species. Juveniles obtain adult body proportions at about 50 mm SL. Approximate total maximum lengths of adults are 900 mm for gray snapper, 446 mm for lane snapper, and 750 mm for mutton and yellowtail snappers. Otoliths are the most preferred body part used to determine age. Most snappers attain sexual maturity after 3-5 years at a size range of 180-350 mm FL. Males mature at a smaller size than females. Recent commercial catches of gray and lane snappers have been increasing, whereas mutton and yellowtail snappers show no clear trends. Sport fishing probably has a substantial impact on the stocks of all four species. All four snappers feed predominantly on small benthic fishes and crustaceans, but yellowtail snapper feed on more pelagic animals. Upper water temperature tolerance limits are 27.2-32.5 °C and lower limits are 11-14 °C.

17. Document Analysis a. Descriptors

Reefs
Coral
Marine fishes
Sea grasses
Growth
Life cycles
Salinity
Temperature

b. Identifiers/Open-Ended Terms

Gray snapper	Lutjanus griseus	Spawning
Lane snapper	Lutjanus synagris	
Mutton snapper	Lutjanus analis	
Yellowtail snapper	Ocyurus chrysurus	

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